The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. LII
No. 1343

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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Complacency in the Chemical Industry

THE opinion of technologists who have visited Britain from other lands during the war has been critical. These men have come to Britain to see what we are doing and to endeavour to help us to improve production in the common interest. It may be that the methods that suit other countries will not suit us. Our total production may be smaller, so that mass production methods may not be applicable; or, as in coal mining, our conditions may not suit machines designed for quite other conditions.

There are, however, standard processes to which these qualifications cannot apply. In these processes there may be inefficiences of which we are not aware, or to which we deliberately close our minds because we do not want to change. "If it is not necessary to change," said Lord Falkland, "it is necessary not to change." That may be true of the government of a country. It is not true of industry. An example may be drawn from iron and steel manufacture. One of the key operations in that industry is the open-hearth furnace in which the metal is melted, impurities are removed from it, and it is converted into steel of the carbon content desired. The steel industry was quite satisfied with its open-hearth furnace practice. Each works manager operated his shops according to his lights and each knew in his own mind that his work was well done. Then, however, some 20 or 25 years ago a fuel expert was appointed to the industry, who started to ask how the results from one works compared with those from another and how British practice compared with foreign. Ultimately, a meeting was convened at which, after some difficulty, the battlements of self-complacency and mutual suspicion were scaled and overcome. The results showed such striking differences between works in this country and left so much to be desired between the results of our works and those of some foreign works, that a thorough investigation was undertaken through the official channels of the steel industry—the British Iron and Steel Federation and the Iron and Steel Industrial Research Council. The result has been a notable improvement in British open-hearth steel practice. We believe, though in this we write without complete information, that British practice is now the equal of any foreign practice. What this

On Other Pages

means in competitive power abroad, and costs of production at home can well be imagined. It was obtained by co-operation between manufacturers who were in competition one with another.

Where does the chemical industry stand? Are we so certain that each works has that little something that its neighbour has not got that we veil our doings in a cloud of secrecy as the steel industry once did? Do we think we know all there is to be known? Heaven knows, we have no cause for complacency. Mr. William Batt, vice-chairman of America's War Production Board and U.S. member of the combined Production and Resources Board, has told us bluntly that British industry must "wake up or pack up. Even before the war," he says, "British industry had fallen hopelessly behind the times. It stuck to methods and tools of its grandfathers' day and was quite incapable of meeting modern competition. Still less will it be able to compete in the world of to-morrow. It is Britain's tragedy that right now she is least fitted to do the things she needs to do, in the area where it is most essential that she should do them—restoration of the world export markets."

We have many established branches of chemical manufacture in this country. Could not they also benefit by combined action? Concrete examples are always better than generalities. Suppose we select the manufacture of sulphuric acid as an example. Many works make acid as part of their internal production, many sell acid to others. Mr. P. Parrish (THE CHEMICAL AGE, January 8, 1944) suggests that our home production of sulphuric acid might well be 2,000,000 tons. It is well known to acid makers that there are, between works using the same processes, differences in yield amounting to at least 10 per cent., and it is safe to say that the yield of acid per unit of sulphur could be increased on most works from 2 to 5 per cent. This would mean greater production, decreased costs, and less imported sulphur. There is clearly room for improvement and for concerted action. To quote Mr. Parrish (*loc. cit.*, p. 33), "It is wrong to assume that no opportunity exists for research in the sulphuric acid industry. At the present time a large number of manufacturers take the line of least resistance, and manufacture sulphuric acid from sulphur. This is a relatively simple process, capable of easy control, and possessing flexibility as regards production, if one knows (a) how to utilise chamber space to the best possible advantage, and (b) how to apportion the Glover and Gay-Lussac towers suitably. But the manufacture of sulphuric acid from anhydrite or spent oxide with H_2S-containing gases, or even with pyrites, is a more difficult problem. Yet the possibilities for the production of cheap sulphuric acid are more alluring, because the difference in the unit price of the respective qualities of sulphur leaves a margin which can be profitably exploited, given correct design and ordered control."

Still pursuing this subject *vis-à-vis* acid manufacture, our readers may be reminded that a number of suggestions for research or improvement were made in Mr. Parrish's 1945 article (THE CHEMICAL AGE, January 13, p. 40). All burners are not equally suited for burning every size of pyrites. Why should not the industry undertake to screen the raw material at the port of entry and despatch the several sizes to works that can best use them? We do this for coal. Why should not every works produce power from the heat of combustion of the sulphur it uses? There are difficulties—but difficulties are there to be overcome. Why should acid makers not have an expert staff to make a survey of every acid plant with a view to its improvement, as has been done in the iron and steel industry? What are the possibilities of designing standardised equipment for acid manufacture? Why cannot the proposed central staff be empowered to erect and operate pilot plants for certain new processes not used in this country, *e.g.*, the simultaneous production of sulphuric and nitric acids?

In selecting sulphuric acid manufacture as the text for this suggestion, we must make it clear that it is no more than an example chosen to illustrate what we believe to be a principle of general application. British industry will survive, and prosper in the future only in so far as it is efficient. Technical efficiency is the basis of many industries and of the chemical industry supremely. It does not matter whether firm A in

Widnes is operating with a slightly higher efficiency than firm B in London. It does not matter if firm C in Glasgow can produce at a slightly lower cost than either firm A or B and thus undersell its competitors or make a little more profit. What will matter supremely is that British industry *as a whole* shall be at least as efficient, and shall be able to produce at as low a cost, as the parallel industries of other countries. To that end we ask that the chemical industry shall face the future realistically and make a serious attempt to ascertain whether combined effort cannot do something that individual isolated management has not been able to achieve, bearing in mind what this co-operative system has done for iron and steel.

There are objections. Of course there are. We can think of a dozen, ourselves. But, as Dr. Johnson said, "Nothing will ever be attempted if all possible objections must first be overcome." Why not make sulphuric acid manufacture a test case, and see what can be done?

NOTES AND COMMENTS

Women Scientists Honoured

IN these days, when there is so urgent a demand for scientific ideas of a constructive nature, it is well that every encouragement should be given to all classes of the community in which such ideas are capable of development; and if a new source can be tapped, so much the better. As we go to press, we have good reason to believe that a historic event is taking place which may well be a big step towards the development of a new reservoir of scientific ability. On Thursday of this week the Royal Society is electing new Fellows, and it is believed to be as good as certain that it will have elected its first women Fellows—if we except Queen Victoria, who was *ex officio* President of the Society. The nominated women are: Mrs. Kathleen Lonsdale, a physicist of the Royal Institution, and Dr. Marjory Stephenson, the Cambridge biochemist. It is profoundly to be hoped that the recognition of their brilliant work will serve as an encouragement to other women to devote themselves to scientific research work.

How to Use Fuel

"EFFICIENT use of fuel can only be achieved as a result of skilled and intelligent operation, maintenance of fuel-using appliances in good condition, development of better appliances, and the judicious application of insulating materials to reduce waste of heat. In this country insufficient attention has been given to the training of fuel technologists and operators, and little attention has been given to the possibilities of insulating buildings with the object of conserving heat. During the war, the need for economy in fuel, and the activities of the Fuel Efficiency Committee of the Ministry of Fuel and Power have stimulated interest, with the result that there is now less waste of fuel and less pollution. There is room, however, for further improvement and it is to be hoped that there will be no slackening of effort in this direction after the war." The above quotation, drawn from the Chadwick Lecture, delivered on March 13 by Dr. A. Parker, Director of Fuel Research at the D.S.I.R., gives a pretty good idea of a subject to which all of us, as fuel users, whether domestic or industrial, will have to give our immediate attention. The title of the lecture was "Coal in Relation to Atmospheric Pollution," but the subject is in fact a far wider one.

Pollution : Its Cause and Cure

POLLUTION from coal, before the war, cost this country a matter of £50 million per annum; and methods are now available, said Dr. Parker, by which considerable reduction can be achieved. Progress, however, must needs be gradual if the demands for certain types of fuel are not to outstrip the supply. Efficiency in method in several directions can effect an improvement, *e.g.*, in improved coal-washing practice, and in the actual use of fuel—for efficient use will cause less fuel to be burnt. There are already in existence highly effective methods whereby smoke can be practically eliminated in large modern boiler installations, and these might well be extended to other

boiler and furnace plants. In addition, there are processes which remove the sulphur oxides from chimney gases before discharge to atmosphere; but these are neither cheap nor easily operated, and, although the task of removing these difficulties is in hand, no immediate solution is in sight. The Fuel Research Station's work over the last few years has resulted in the evolution of simple and easily-operated equipment to modify the doors of Lancashire and marine boilers, whereby the emission of smoke can be practically eliminated, and the value of this equipment has already been fully demonstrated. Remains the domestic fire, relatively the worst offender. New designs of grate, reducing the amount of smoke to about half have been designed, but are not yet in general use, and in the long run it would seem that, so far as domestic appliances are concerned, encouragement should be given to the use of coke, gas, and electricity in place of coal, within economic limits, if atmospheric pollution is to be greatly reduced.

Imports to India

A FIRST step in the abolition of war-time import controls has been taken in India by the issue at New Delhi on March 2 of an Open General Licence, which will enable any Indian importer to import from the United Kingdom a wide range of consumer goods without an import licence. Besides the expected items, such as clothing, electrical household appliances, and paper and books, certain pharmaceuticals and chemicals are also covered by the licence, as well as photographic goods, toilet requisites, and glass bottles and glassware. A complete list will be published in the next issue of the *Board of Trade Journal*. The action taken in India, we are informed, has been rendered possible by the improved shipping position and is designed to encourage increased exports from the United Kingdom to India of consumer goods of which India stands badly in need. The abolition of the Indian import licensing formalities, which have been in force since 1942 for the classes of goods involved, should enable United Kingdom traders to increase their sales in the Indian market as additional supplies become available in the immediate future, especially after the end of the war with Germany. The removal of import restrictions by an overseas importing country such as India is complementary to the action taken in the United Kingdom to free as wide a range of goods as possible from export control and thus enable export trade to increase to the maximum extent possible with the restricted labour force available to manufacturers and shippers.

Royal Society

Distribution of State Grants

THE Royal Society has been informed by the Treasury that the following grants, which are administered by the Society, have been provided in the estimates for the fiscal year 1945-46: for scientific investigations, £14,000, for scientific publication, £7000, and for scientific congresses, £1600. In view both of the greater amounts available and of the present changing conditions, the Society has decided that more frequent allocation was desirable. The last dates for making allocations are: for grants for scientific investigations, March 31, July 31, and November 30, 1945; for grants for scientific publication, June 15 and November 15, 1945.

A Courtauld Endowment

Chair of Chemical Engineering

COURTAULDS, LTD., have decided to endow a Chair of Chemical Engineering at the Imperial College of Science and Technology, a School of the University of London, which has had no professor in this subject for some years past.

Announcing this decision in his annual statement, Mr. Samuel Courtauld, after having made reference to the resolution passed by the board last June to provide £500,000 for the encouragement of independent scientific and technological research at the universities, pointed out that it necessarily took a good deal of time to balance the different claims and to give them final effect, but that the endowment of the above-mentioned chair was already "definitely settled."

MR. T. MARTIN succeeds MR. T. H. HEWLETT, M.P., J.P., as managing director of the Anchor Chemical Co., Ltd. Mr. Martin has been associated with the company for some 30 years, and was latterly assistant managing director. Mr. Hewlett was one of the first directors when the company was formed in 1907; he was appointed managing director in 1923 and chairman in 1935, and this last position he retains.

Magnesium Production—II

Developments in Thermal Reduction Processes

by D. D. HOWAT, B.Sc., Ph.D., F.R.I.C., A.M.I.Chem.E.

(*Continued from* THE CHEMICAL AGE, *March* 17, 1945, *p.* 243)

THE Ford Motor Co. has patented[10] a reduction furnace designed to use oil as the shock-cooling medium, the main outlines of the plant being shown in Figs. 5 and 6. As indicated in these figures, the main body of the furnace is cylindrical in cross-section with single-phase electric power supplied to two directly-opposed vertical electrodes. A bolted steel casing houses refractory brick insulating lining, while the actual walls of the furnace are formed by carbon blocks. cooled copper electrode sleeve encloses the upper electrode, while a stream of nitrogen is introduced through a channel in the electrode holder. According to the patent, the nitrogen stream raises the pressure within the furnaces to slightly above atmospheric, while the direction of flow of the nitrogen prevents condensation of magnesium vapour on the cooler parts of the electrode or the gland.

A tapered carbon block held within a steel

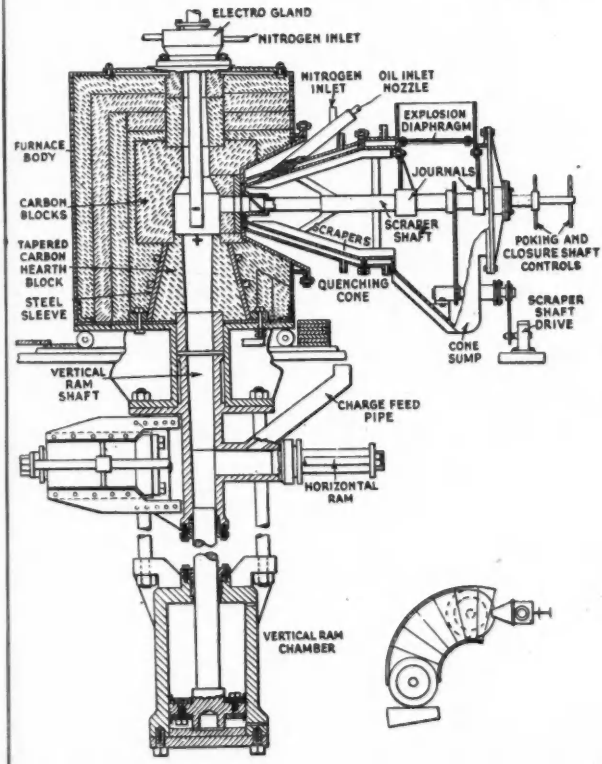


Fig. 5. Ford Motor Co.'s carbo-thermic reduction furnace, showing the arrangement of the oil-quenching mechanism in the cone in relation to the furnace (B.P. 559,866).

Fig. 5a.

The small size of the actual furnace chamber in relation to the size of the body should be noted as it constitutes a definite feature of all electric arc furnaces used for the carbo-thermic reduction of magnesia. A water-housing bolted to the base of the furnace forms the hearth of the furnace chamber, the charge being introduced upwards through a central hole in this block. Two hydraulic rams, one horizontal and the other vertical,

are employed to produce a compact charge and to force the compressed material up into the furnace chamber. The charge is introduced into the horizontal ram chamber by a feed pipe, the ram then forcing the partially compacted charge into the chamber of the vertical ram. Air, expelled from the charge, escapes past the pistons. When in position, the charge must act as part of the electrical circuit in the furnace, hence the necessity for the expulsion of all air and the production of a highly compact material. By interlocking the feed of the vertical ram with the power input to the electrode, the charge is forced upwards at a controlled rate, so that the top layer of material is maintained at the level of the base of the furnace chamber. Considerable side thrusts are set up during the movement of the charge, and it has been found necessary to form the carbon base blocks of the furnace in the tapered fashion already indicated.

A gaseous mixture of magnesium metal vapour and carbon monoxide, together with the nitrogen introduced at the electrode holder, passes through the tap hole to the cone. As shown in Fig. 5, the cone comprises two sections, the front portion, shaped like a frustum of a cone, flaring outwards from the tap-hole, while the back portion, shaped like a hollow cylinder, is provided with an explosion diaphragm, a sump, and journals for an assembly of shafts. The flared portion of the cone is oil-jacketed and is equipped with a ring of jets through which oil is sprayed into the interior. An outer jacket around each jet allows nitrogen to be introduced into the cone. The inner jet

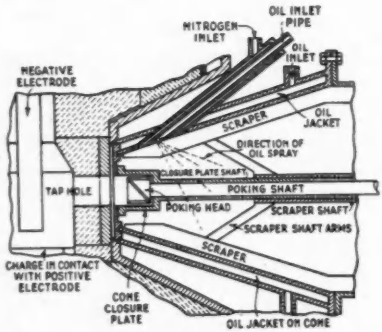


Fig. 6. Enlarged view of quenching cone (see Fig. 5), showing relation of tap hole, oil sprays, and poking and scraper shafts (B.P. 559,866).

tube is replaceable and is removed when the nozzle becomes blocked. By introducing a stream of nitrogen the jet tube may be replaced without air finding its way into the cone. As shown in detail in Fig. 6, the wall of the furnace body is constructed with a suitable recess into which the tapered part of the condensing cone fits, so shortening the length of passage between the arc and the point at which condensation begins. This factor is of vital importance in the design of any furnace/condenser unit in magnesium reduction by carbon. Fig. 6 shows how the outer wall of the cone abuts against a tapered ring in the furnace casing. Housed within the cone are three concentric shafts. The innermost shaft carries at its end a reamer which may be forced into the tap hole of the furnace to remove accretions, this reamer shaft being operated by an external handle. The central aperture in the cone may be closed by a sealing device carried on the end of the intermediate shaft. Mounted on the exterior of the seal shaft is a scraper shaft fitted with extending arms and scraper blades. Rotating just within the cone walls, these scraper blades remove any deposited material whether of magnesium metal vapour or slag. This assembly of shafts is supported by two journals as indicated in Fig. 5.

The furnace body, including the charging mechanism, is movable, being supported on wheels running on rails, arranged in the form of an arc of a circle (arrangement indicated in Fig. 5a). In this way easy access is provided to the interior of the furnace or cone. By maintaining the admission of nitrogen through the electrode holder, access of air to the furnace space is prevented, while the sealing device may be employed to prevent air from entering the condensing cone. These features are claimed by the inventors as outstanding advantages.

During furnace operation oil under pressure is sprayed into the cone, the nozzles being arranged to cause the oil spray to be directed slightly forward towards the larger end of the cone. A number of previously formed magnesium particles are circulated with the oil to act as nuclei for further magnesium metal vapour condensation. Oil, containing the condensed magnesium metal, collects in the sump of the cone from which it is removed for further treatment and separation of metal, the conveyor line including a trap to prevent access of air to the interior of the cone.

Molten Metal Cooling

Several patents have also been granted covering the employment of molten metals as shock-cooling media. A recent patent[11] granted to the Dow Chemical Company claims the use of a molten metal which is miscible with and has a boiling point lower than that of magnesium, and is supplied at such a temperature that the magnesium dissolves therein. Lead promises to be the most suitable metal for this purpose, the gaseous mixture of magnesium metal vapour and carbon monoxide being passed into a

shower of molten lead in a condensing tower. Although at present only in the experimental stage, this process may prove of value in large-scale plants in the future.

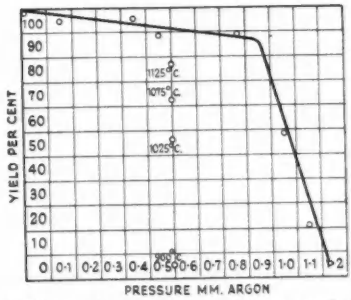
Ferro-Silicon Reduction Process

Although not a single commercial plant using ferro-silicon was in operation in the U.S.A. or Canada before 1941, this reduction process has in four years assumed a position of major importance in the light metal industry. Its outstanding advantages are the utilisation of dolomite ores, the production of magnesium in a dense, compact, crystalline form, easy to handle and non-pyrophoric, and the comparatively straightforward character of the plant. Until now the relatively high price of the ferro-silicon has proved the only disadvantage, but this may show substantial reduction in the future.

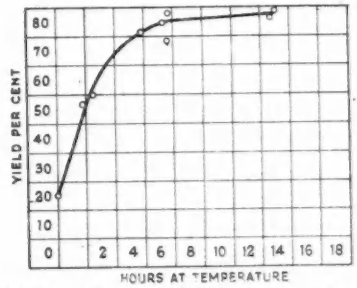
According to Bagley[12] the principle of magnesite reduction by ferro-silicon was discovered by Mallet in 1877. Attempts were made to use pure silicon by Bleechner and Morrison in the United States in 1915, and by I. G. Farbenindustrie in Germany in 1934. To Dr. L. M. Pidgeon, of the National Research Council of Canada, must be awarded the credit for the development of this process to a commercial success during the present war. Without this process it is exceedingly doubtful whether magnesium production in the U.S. would have risen to anything like the present phenomenal figure. Unfortunately, all the developments have occurred in the U.S. and Canada, lack of ample supplies of hydro-electric power in this country having precluded production of ferro-silicon in the quantities necessary. As mentioned earlier in this paper, only the Hansgirg process for magnesium production has been established in Britain, in addition to the conventional electrolytic process, the aluminium reduction process of International Alloys, Ltd., and the use of calcium carbide as a reducing agent being purely war-time expedients.

Some experimental work on the characteristics of the ferro-silicon reduction reaction, described by Bagley,[12] was carried out in a high-frequency vacuum furnace, Fig. 7(a) and (b) indicating the effects of pressure and temperature on the yield of magnesium. Although the experimental results show that no serious reduction in efficiency occurs up to a pressure of 0.9 mm., pressures considerably less than this have been found desirable in plant operation. Temperature of the reaction plays an important part in the yield of metal, a drop of only 25° C. in the reaction temperature appearing to be capable of reducing the yield by 10-15 per cent., as will be evident from Fig. 7(a). So far as the reduction temperature is concerned, a compromise must be made between high yields and the life of the nickel-chromium alloy tubes from which the retorts are made, 1150° C. representing the practical operating limit for such materials. Results plotted in Fig 7(b) were obtained from a semi-scale furnace containing a 50-lb. charge. In this furnace, heating was provided from resistance elements supported by a heat-insulating refractory inside the retort tube. A yield

Fig. 7. Effects of pressure, temperature, and time on yield of magnesium metal from the dolomite-ferrosilicon reaction (BAGLEY).



(a) Effect of pressure and temperature. Conditions, 2 hrs. at 20 gm. charge, 1150°C.



(b) Effect of time. Pilot furnace ; 50 lb. mix, 1165°C.

of 85 per cent. was obtained in eight hours at 1165° C., the results in Fig. 7(b) indicating that no appreciable increase occurs if the time is prolonged beyond this period.

On the purely chemical side the reduction of magnesite by silicon may be written as:

$$2MgO + Si \rightarrow 2Mg + SiO_2 \quad \ldots\ldots\ldots\ldots (2)$$

In ordinary practice, the silica produced did not remain as such but combined with unreduced magnesite to form magnesium silicate, the reaction being:

$$4MgO + Si \rightarrow 2Mg + Mg_2SiO_4 \quad \ldots\ldots\ldots (3)$$

If dolomite (containing magnesite and lime in equimolecular proportions) is available, the lime combines with the silica to form

calcium silicate, substantially all the magnesite being reduced to metal:

$$2(MgO.CaO) + Si \rightarrow 2Mg + Ca_2SiO_4 \quad (4)$$

The charge must therefore be adjusted to contain equimolecular properties of magnesite and lime. In the ability to use ordinary dolomite, so much more plentiful and considerably cheaper than magnesite, lies one of the superb advantages of the ferro-silicon process. As the reducing agent, 75 per cent. ferro-silicon is normally employed, but the iron appears to play no part in the reaction, being returned in the residue.

The Spokane Plant

Bagley[12] states that, in designing the new magnesium plant of the Electro-Metallurgical Co., of New Spokane, Wash., an important decision had to be made with regard to retort construction. The method adopted elsewhere has been to use externally-heated horizontal retorts made of heat-resisting alloys. Such a procedure enables gas fuel to be employed, but limits the diameter and capacity of the retort. A limit is also set to the operating temperature, the life of the retorts being rapidly reduced if the temperature is allowed to rise above the optimum value, while the most severe thermal effects are suffered by the outside of the tube.

Greater difficulties in design are experienced if the electric heating elements are incorporated inside the retort, while the cost of resistance heating is greater than gas. Definite advantages are offered, however, in the possibilities of increased retort diameter, the use of cheaper construction materials, reduced heat losses, and greater ease of charging and discharging, by the employment of vertical retorts. Apparently, test results have indicated that reduced operating costs with the larger units outweigh the increased costs of electric heating. Hydro-electric power was available at cheap rates from the Grand Coulee Dam, a factor undoubtedly of decisive importance.

In the final plant design 432 furnaces were incorporated. From the published photographs and volume figures each furnace shell appears to be about 15 ft. high by about 6 ft. in diameter. A pressure of only 0.1-0.2 mm. was required to permit the condensation of the metal in a compact, dense form, the total volume which has to be evacuated being about half a million cubic feet. Four sets of steam jet pumps were provided, each set serving 108 furnaces. Ferro-silicon is produced in the plant in the required quantities, while the dolomite is mined in adjacent quarries. Large rotary kiln furnaces are employed to burn the dolomite, waste heat from the kilns being utilised to raise steam for the jet vacuum pumps. Burned dolomite and ferro-silicon are ground separately to about 300-mesh and are then mixed and briquetted in roll presses. After charging, the furnace is heated to the required temperature and held for the prescribed time under vacuum. Suitable alloy steels being difficult to obtain, ordinary mild steel was employed in the construction of the furnaces and of those parts holding the charge. In view of this the temperature is allowed to fall considerably before the furnace vacuum is broken, as inflow of air at the high temperatures would cause appreciable scaling and shorten the life of the furnace components. The annual capacity of the plant is 24,000 tons of magnesium.

Ford Magnesium Plant

Stedman[13] writes that experimental work at the Michigan plant of the Ford Motor Co. proved that the optimum size for externally-heated retorts was 10 in. diameter and 22 ft. long, the first furnace being started up in the spring of 1942. Dolomite from the Michigan quarries is burned in rotary kilns and mixed with ferro-silicon in the approximate ratio of six to one. The mixture, after being ground in large compartmented ball mills, is briquetted in roll presses.

Reduction furnaces, 19 ft. high, 16 ft. wide, and 18 ft. long, are arranged in rows. Through the middle of each furnace are two tiers of nichrome steel retorts, six in the lower row and five in the upper. The middle 13 ft. of each retort is housed in a hot zone of the furnace with a length of 31 in. projecting from either side of the casing. Purified coke-oven gas is the fuel used for heating, gas jets being set on each side of the furnace. Exhaust gases pass up through a chamber on the top of the furnace in which the briquettes are preheated before being charged to the retorts. The retorts, supported on refractory brick arches inside the furnaces, are charged from both ends. Split steel sleeves fit inside the projecting ends of the retorts, providing condensing surfaces. Gas-tight metal caps are employed to close the ends of the retorts, each of which is coupled to the vacuum pump manifold by a 1½-in. pipe. Four vacuum pumps, each with a capacity of 100 cu. ft. per min., and driven by a 5-h.p. electric motor, maintain the required low pressure in the retorts.

A charge of 350 lb. charged to the retort yields about 70 lb. of magnesium metal in the eight-hour cycle. Maintenance of the vacuum assists in drawing the magnesium vapour into the cooler parts of the retort, condensation occurring on the split sleeves. After eight hours the vacuum is broken, the sleeves bearing the metal deposits are withdrawn, and the residue cleaned out of the retort. Up to the date of the paper, all charging and discharging of the retorts was being done manually. A diagrammatic flow sheet of the plant is shown in Fig. 8.

At the Canaan, Conn., plant of the New England Lime Co.,[14] 20 reduction furnaces

are employed, each containing 20 retorts arranged in four banks of five. Construction of the furnace, with refractory brick supporting arches, follows the same pattern as those previously described. Producer gas is the fuel, heating efficiency being increased by fitting regenerators to the furnaces. A briquetted mixture of burned dolomite and ferro-silicon is charged by hand to the retorts, the output of magnesium per retort being about 25 lb. in the eight-hour cycle. Olive gives a brief account of the vacuum pump system in use at this plant. After the bank of retorts has been charged and sealed, connections are made to the rough vacuum line through which the retorts are evacuated to a pressure of 0.5-1 mm. by a single-stage oil-sealed rotary mechanical pump. When this pressure has been attained the retorts are connected to the high vacuum line for further evacuation to the final operating pressure of 10-15 microns, the changes in pressure with time being shown in Fig. 9. For each bank of retorts the high vacuum equipment comprises a group of five 4-in. diameter multi-jet mercury diffusion pumps of welded steel construction. These pumps discharge against a fore-pressure of 0.5-1 mm. to the single oil-sealed rotary high-vacuum backing pump with a capacity of 100 cu. ft. per minute. Oil from the backing pump is continuously circulated through a purification system to remove condensed water and other contaminants capable of flashing back into the system and raising the fore-pressure to a value against which the diffusion pumps could not operate. From the gas mains to the furnace tappings are taken to feed producer gas to the mercury boilers of the diffusion pumps, the gas consumption being about 100 cu. ft. per hour per pump. Ordinary tap water is employed for cooling the pumps.

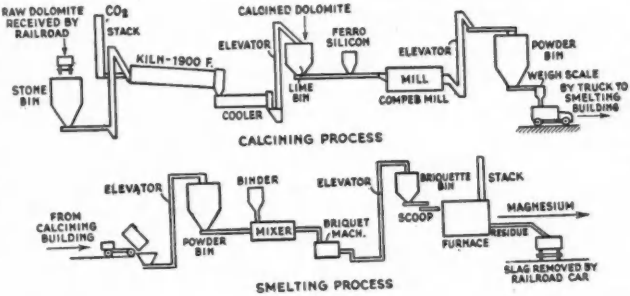


Fig. 8. Flow-sheet for the production of magnesium from dolomite by the ferro-silicon process, as used by the Ford Motor Co. Calcining is carried out in a former cement plant. Half the weight of the stone is removed as CO_2 during calcining (STEADMAN).

Economics of the Processes

In comparison with the other processes for the production of magnesium the most expensive single item in the Pidgeon process is the cost of the ferro-silicon reducing agent. According to the calculated amounts involved in the reduction equation, 0.583 lb. are required for each lb. of magnesium produced. The ferro-silicon normally used is the 75 per cent. grade, selling in the U.S.A. at about $135 per ton. At this figure 1 lb. of silicon will cost approximately 8 cents. Allowing for ordinary losses in the reaction, the reduction reagent will cost 5.5 cents per lb.

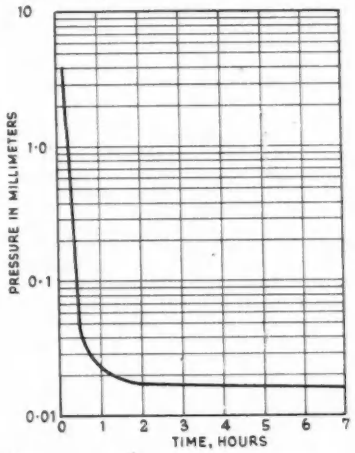


Fig. 9. Typical pump-down curve on bank of magnesium retorts fitted with 4-in. mercury diffusion pumps (OLIVE).

of magnesium produced. Other substantial cost items are maintenance and fuel.

In carbon reduction, 0.43 lb. of carbon are required per lb. of magnesium produced. Even with anthracite duff at 30s. per ton, the cost of the reduction reagent in this case is no more than 0.16d. per lb. of magnesium produced. According to the report of the Select Committee on National Expenditure,[4] the company operating the carbon reduction process here in Britain hopes that, when a

substantial output is achieved, costs will fall to a figure somewhere near 1s. 6d. per lb. An additional note in this report[4] shows that the cost of producing magnesium in Britain by the electrolytic process is 1s. 7d. per lb.

Breyer[15] calculates that the capital cost of a ferro-silicon reduction plant is low, being about $1½ to $1½ for each $1 of metal sales per year, working on the basis of a plant of 10 tons per day capacity. Working on the present price of 20 cents per lb. of magnesium, a plant with a yearly capacity of 3500 tons per year will cost from $1,750,000 to $2,000,000. Breyer[15] maintains that capital costs of this order are strictly comparable with those for any other of the magnesium production processes whether electrolytic or carbothermic.

In trying to arrive at a rough estimate of the operating cost of the ferro-silicon process, Breyer draws an analogy with zinc retort smelting. Pointing out that the retorts are approximately the same size, that operating temperatures are almost identical, while labour in charging and discharging is very much the same, he[15] shows that the ferro-silicon process is more expensive in the cost of retorts (expensive alloy steel against refractory) and in vacuum pumping and equipment. If recoverable zinc in a zinc ore costs 2.5 cents per lb., the metal may be produced by the retort process and sold at a profit at 6 cents per lb., *i.e.*, operating costs are about 3½ cents per lb. Assuming that the retort process for magnesium will be two to two-and-a-quarter times the cost for zinc, we obtain a figure of 7 to 8½ cents per lb. of magnesium produced.

With calcined magnesite costing almost 3 cents per lb., and assuming only 80 per cent. recovery of the magnesium, the cost of the magnesium as ore is about 6 cents per lb. On these very tentative figures we arrive at a total production cost of 20 cents per lb. of magnesium, 6 cents for metal as ore, 5.3 cents for reduction agent, and 8½ cents for smelting costs. This rough calculation is in agreement with the known fact that, at present, production of magnesium by the ferro-silicon process cannot quite compete with the 20 cents per lb. price of magnesium produced by the electrolytic process.

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Phenoxetol

A Promising Antibacterial

AN interesting point in the Annual Report of Research (1944) of the College of the Pharmaceutical Society of Great Britain is the account of the work done by the Department of Pharmaceutics on phenoxetol. This is the name that has been suggested for the monophenyl ether of β-phenoxyethyl alcohol ($C_6H_5OC_2H_4OH$). Phenoxetol is a colourless, odourless, somewhat viscous liquid, heavier than water, and soluble in it to the extent of 2.5 per cent. v/v at 20°C. In bactericidal and bacteriostatic tests, it was found to be weakest against staphylococci, better against streptococci, and strongest against *Pseudomonas pyocyanea*, a gram-negative organism which is the cause of "blue pus" in wounds. This organism is unaffected by penicillin, and resists the action of the sulphonamides, the acridine compounds, and the quaternary ammonium compounds. A special advantage of phenoxetol is that it is compatible with all the above chemotherapeutic agents, and can be used in conjunction with them, thus "boosting" their action against pyocyanea. In clinical trials it was found to cause no discomfort, and its use as an ingredient of Penicillin Cream has shown particular promise. No toxic effects have been noted, the largest amount used on man having been 40 c.c. of a 2.2 per cent. solution applied on gauze daily to a large granulating wound.

NEW KESTNER DRIER

KESTNER EVAPORATOR & ENGINEERING CO., LTD., have just issued leaflet No. 265, dealing with the new Kestner T.V. Drier, recently developed specially for drying filter press cakes and semi-solids. It is stated that successful results are being obtained in drying centrifuged materials and deposited sediments such as chalk, china clay, stearates, boric acid, sand, certain synthetic resins, etc.

Based on simple principles, drying is effected by a current of high-velocity hot air or gas which carries the wet material through the plant, until it is discharged as a dry powder. Evaporation takes place by direct contact between the wet material and the hot air or gas; there are no heated tubes or surfaces. No mechanical devices are required to keep the material moving. As can clearly be seen from the diagram illustrating the leaflet, the plant comprises six essential parts.

A range of standard sizes is made, dealing with materials at a rate varying from ¼ cwt. to 10 tons per hour. The apparatus appears to justify its claims for simplicity, efficiency, and compactness.

Parliamentary Topics

Carbonisation Plant

AT question time in the House of Commons, Mr. Tom Brown asked the Minister of Fuel and Power whether his Department would give consideration to the installation of a low-temperature carbonisation plant in the coalfields of S.W. Lancashire as part of the post-war plan.

Major Lloyd George said that he was not aware of the submission of this proposal but that he would look into it. There was no reply when Mr. J. Griffiths asked whether the Department had considered this matter of the development of the oil and coal industries in a general way, as there was a committee doing a very considerable amount of research at the moment.

Polythene

Mr. Ellis Smith asked the Minister of Supply on what date polythene was perfected; whether it was sent to Du Ponts of U.S.A. before the U.S.A. entered the war; and whether I. G. Farbenindustrie were furnished with the secrets of polythene in accordance with pre-war arrangements.

Mr. Peat: Small-scale production of polythene began before the war, but continued improvements have since been made. I.C.I., Ltd., inform me that Du Pont were furnished with research information and samples over a period before the war and were given detailed manufacturing information in November, 1941, for the purpose of erecting a plant on behalf of the United States Government. I.C.I. also inform me that they have not at any time supplied information concerning polythene to I. G. Farben.

Mr. Smith: Did Du Pont, in accordance with their pre-war arrangements, inform I. G. Farben of this British invention?

Mr. Peat: Under the agreement between I.C.I. and Du Pont, all the information furnished by I.C.I. was to be strictly confidential, and for the use of Du Pont only. This applies to information on any subject, but having regard to the secrecy of polythene, a letter was sent to the chairman of Du Pont by Lord McGowan on September 17, 1941, stressing the importance of keeping secret the uses for which polythene had already proved itself in this country.

Mr. Smith asked further whether Lord McGowan's request to the American company was carried out, and whether the House could have a "Yes" or "No" to the question whether I. G. Farben were informed of this British invention.

Mr. Peat's reply was that he could not answer for Du Pont. Up to date there was no evidence that this material had been used by Germany.

[E. I. Du Pont de Nemours & Co. have issued the following statement on the subject:

"Du Pont never had any general agreement with I. G. Farbenindustrie or any other German company providing for disclosure of technical information, and specifically had no agreement whatever dealing with polythene.

"The company has abided strictly by the letter and spirit of the terms under which manufacturing rights were obtained from Imperial Chemical Industries, of England. As far as Du Pont is concerned, all information on polythene has been completely protected for exclusive use by the Allied Nations."]

Gammexane

Brigadier-General Clifton Brown asked the Minister of Agriculture whether the new insecticide Gammexane had yet been proved effective against wire worm; and whether it would be available to farmers for this year's spring sowings.

Mr. Hudson: I have not yet had definite evidence that this insecticide is effective against wire worm. A supply of it is available.

Water Research

Mr. Price asked the Lord President of the Council whether consideration had been given to establishing one central water research laboratory, to which all water undertakings could contribute for furthering research which is common to their interests.

Mr. Attlee: The D.S.I.R., through its Water Pollution Research Organisation, already serves as a central research organisation for the study of problems inherent to the supply of water. Many water and other undertakings already contribute valuable help to this work, which the department proposes to extend after the war. In addition, the Geological Survey of the D.S.I.R. can provide, for water undertakings, advice about underground water supplies, based on its study of geological data. Such information will be considerably enlarged if the powers sought in Clause 7 of the Water Bill are conferred by Parliament.

Fertilisers

Mr. Ross Taylor asked the Minister of Agriculture the number of applications received during the last three years for permission to institute proceedings in accordance with the provisions of Section 20 (1) of the Fertiliser and Feeding Stuffs Act, 1926; and in how many of such cases his consent had been withheld.

Mr. Hudson: The number of applications made by local authorities during the period 1942 to 1944 was 25, and in 14 of these I found it necessary to withhold my consent.

In reply to a question by the same Member, the Minister of Agriculture said that, during 1944, 1722 samples of fertilisers were submitted for analysis as set out in the quarterly returns made by local authorities under Section 18 of the Act.

The Trend of War-Time Earnings

An Analysis of Audited Accounts

by S. HOWARD WITHEY, F.C.I., F.Comm.A., M.I.Ec.E.

IN spite of the restrictions on supplies and the withdrawal of staff, the majority of firms engaged in the chemical industry report increased earnings, with the result that reserve allocations show a tendency to expand and larger balances are carried forward. *Timothy Whites and Taylors, Ltd.*, report a trading profit of £538,500 for the year to December, 1943, representing an increase of £98,722 as compared with the previous year's figure, thus constituting a new high record. After providing £237,500 for taxation and £67,721 for deferred repairs and renewals, the balance of net profit is £138,213, against £137,077 in 1942, and £136,534 in 1941, enabling the rate of dividend on the ordinary capital to be maintained at 30 per cent., and £2593 to be added to the forward balance. This chain store combine was registered in 1928 and has 800 branches and reciprocal trading agreements, expiring in 1970, with Taylors (Cash Chemists) and Taylors Drug Co. Of an authorised capital of £3,176,000 a total of £2,161,793 has been issued and fully paid; this comprises £1,676,000 in 7½ per cent. cumulative preference £1 shares, and £485,793 in ordinary shares of 5s. The debenture debt amounts to £1,456,900, made up of £1,000,000 in 4 per cent. stock and £456,900 in 5 per cent. stock, the debenture interest totalling £63,328, and the final appropriation account is made up as follows:

	£	£
Brought forward from 1942 ...		77,686
Net profit: year ended December 31, 1943		138,312
Disposable balance		£215,998
7½ per cent. dividend on £1,676,000 cum. pref. £1 shares	£125,700	
Less income tax at 10s. in the £	£62,850	62,850
30 per cent. dividend on £485,793 ordinary 5s. shares	£145,738	
Less income tax at 10s. in the £	£72,869	72,869
Carried forward to 1944		80,279
		£215,998

The freeholds have a balance sheet value of £1,723,070, and other fixed assets amount to £389,737. Subsidiary companies are shown at £1,367,188, goodwill at £324,382, and at £1,402,812, the current assets show a surplus of £184,408 over current liabilities. In 1943, the ordinary 5s. shares reached 34s. 3d., the lowest price during the year being 24s. 6d., and recently they were quoted at 39s., at which price the actual return is 3.8 per cent. At 32s. 6d. the preference £1 shares yield over 4½ per cent.

During 1943, the net earnings of *Joseph Crosfield and Sons, Ltd.*, amounted to £644,747, representing an improvement of £91,425 in relation to the previous year. While the profit was £1,040,472, as compared with £1,210,224, the charge for taxation was only £319,067, compared with £560,041, and the allocations for depreciation and deferred repairs were lower. This has enabled the dividend on the ordinary capital to be increased from 40 per cent., less tax, to 25 per cent. tax free (equal to 50 per cent., less tax), and the carry-forward to be raised by £42,247. Registered in 1896, the company directly controls D. C. Keeling & Co., Ltd., the Erasmic Co., Ltd., J. & E. Atkinson, Ltd., and Medley & Son, Ltd., the authorised capital being £10,000,000. The issued capital totals £4,900,000 and consists of £400,000 in 5 per cent. cum. pref. £1 shares; £500,000 in 5 per cent. cum. pref. £1 shares; £1,000,000 in 6½ per cent. cum. pref. £1 shares; £1,500,000 in 7½ per cent. "A" cum. pref. £1 shares; and £1,500,000 in ordinary £1 shares. The following is a summary of the 1943 appropriation account:

	£	£
Brought forward from 1942 ...		191,381
Net profit: year ended December 31, 1943		644,747
Disposable balance		£836,128
5 per cent. dividend on £400,000 cum. pref. £1 shares, gross ...		20,000
6 per cent. dividend on £500,000 cum. pref. £1 shares, gross		30,000
6½ per cent. dividend on £1,000,000 cum. pref. £1 shares, gross		65,000
7½ per cent. dividend on £1,500,000 "A" cum. pref. £1 shares, gross		112,500
25 per cent. dividend on £1,500,000 ordinary £1 shares, tax free ...		375,000
Carried forward to 1944		233,628
		£836,128

Fixed assets are shown on the balance sheet at £5,090,204 and current assets at £1,298,669. At the recent price of 26s., the 5 per cent. preference shares return 3.8 per cent., and at 29s. 6d., the 6 per cent. preference give 4 per cent. Recently, the 6½ per cent. were quoted at 31s. yielding 4.2 per cent., and at 34s., the 7½ per cent. preference return 4.4 per cent. The ordin-

ary shares are owned by Lever Brothers & Unilever, Ltd.

Royalties and other income received by *International Bitumen Emulsions, Ltd.*, during the twelve months ended March 31, 1944, totalled £31,846, which figure compares with £22,706, shown in the previous account. After charging general expenses, the profit was £26,015, an improvement of £8714 in 1942-43, but at £14,800, the provision for taxation is £7663 higher, so that after reserving £500 for depreciation, as against £82 previously, the balance of net profit for the year shows an increase of £633 at £10,715. Registered in 1928, the company owns or controls patents and trade marks of processes for the manufacture of pure bitumen emulsions used for spraying and grouting roads and for general industrial purposes throughout the world, and its products are sold under such names as Bitumuls, Bituproof, Colfix, Ibecco and Lomix. Its interests include International Colfix, Ltd., and it also owns all the capital of British Bitumen Emulsions, Ltd., and of other concerns. The issued capital is £222,668 in ordinary shares of 2s. 6d., on which the rate of dividend has been increased from 6 per cent. to 7 per cent., and after allocating another £3000 to the dividend equalisation reserve, the forward balance remains slightly higher, as shown below:

	£
Brought forward from 1942-43	2902
Net profit: year ended March 31, 1944	10,715
Profit on sale of invesments ...	274
Disposable balance	£13,891
7 per cent. dividend on £222,668 ordinary 2s. 6d. shares £15,586	
Less income tax at 10s. in the £ £7793	7793
Allocated to dividend equalisation Reserve	3000
Carried forward to 1944-45 ...	3098
	£13,891

Shares in subsidiaries are shown on the balance sheet at £129,460, and shares in associated companies at £34,644. The current assets amount to £40,345, and the surplus over current liabilities is £15,124. The shares were recently quoted around 3s.

The final figures of the *United Indigo and Chemical Co., Ltd.*, are made up to the end of June last, disclosing a net profit of £9831 for the year. This was arrived at after debiting taxation, and compares with £9655 in 1942-43, and £9305 in 1941-42. This company was formed in 1899, and specialises in the manufacture of indigo and chemicals, and in the production of dog and poultry foods, directly controlling a number of concerns. The authorised capital is £300,000, of which a total of £142,500 has been issued and fully paid, consisting of £90,000 in the form of 5 per cent. cumulative preference shares of 7s. 6d. which rank *pari passu* with the ordinary shares after paying a non-cumulative 5 per cent. on the latter, and £52,500 in ordinary 2s. shares. The dividend on both classes has been maintained at the rate of 6¼ per cent., calculated at the gross amounts, the carry-forward then showing an increase of £925, thus:

	£
Brought forward from 1942-43 ...	16,739
Net profit: year ended June 30, 1944	9831
Disposable balance	£26,570
6¼ per cent. dividend on £90,000 cum. pref. shares of 7s. 6d., gross	5625
6¼ per cent. dividend on £52,500 ordinary shares of 2s., gross ...	3281
Carried forward to 1944-45 ...	17,664
	£26,570

In 1943, the preference shares reached 9s., the lowest price during the year being 7s., and recently they were quoted at 8s. 9d. The ordinary shares fluctuated between 1s. 6d. and 2s. 4½d. in 1943, and were recently quoted at 2s. 6d. The company has extended its production, and profitable results in the post-war years are expected.

The net profit of £484, reported by the directors of *United Lubricants, Ltd.*, for the twelve months ended March 31, 1944, includes £203 from the income-tax account, and represents an improvement of £30 in relation to the preceding year when, £188 was included from income-tax. The company was formed in 1930, and the assets now consist almost entirely of all the shares of London Lubricants, Ltd. Of an authorised capital of £60,000 a total of £30,000 is in issue, consisting of £25,000 in 8 per cent. cumulative preference shares of 5s. each, and £5000 in ordinary shares of 6d., and after meeting the preference dividend for the half-year ended March 31, 1943, the forward balance is £16 smaller:

	£
Brought forward from 1942-43 ...	59
Net profit: year ended March 31, 1944	484
Disposable balance	£543
Dividend on 8 per cent. cum. pref. 5s. shares for half-year ended March 31, 1943, ... £1000	
Less income tax at 10s. in the £ £500	500
Carried forward to 1944-45 ...	43
	£543

New Chemical Apparatus

Useful Laboratory Accessories

AMONG new developments in chemical apparatus, an interesting item made by Baird & Tatlock (London), Ltd., is the B.T.L. Photoelectric Turbidimeter and Colorimeter (Fig. 1). The design of this instrument is the result of collaboration between the B.T.L. Research Laboratory and the Metropolitan Water Board Laboratories. The original object in view was the measurement of the turbidity of water supplies, but there is no reason why the instrument should not be employed in the measurement of the turbidity or clarity of almost any other fluid, or for analytical processes which depend, or may be made to depend, on turbidity measurements, or on the measurement of colour intensity.

Special advantages claimed for this turbidimeter include high sensitivity (up to one part of suspended matter in ten million parts of water), and convenience of manipulation. The instrument is light-tight and economical of current, while the intensity of light available is variable over a wide range. It has been successfully used in problems of petroleum technology and for the determination of sulphur in steels.

Another convenient accessory to the chemical laboratory which has been produced by the same firm is the B.T.L. Universal Electric Stirrer (Fig. 2). This is designed to carry out every stirring operation in a convenient manner, the keynote of its construction being adaptability. It consists of a number of component parts: (1) a high-speed motor with controlling rheostat, chuck and pulley, mounted on stand (the basic unit); (2) a special bracket attachment with pulley, etc; (3) glass and metal stirrers of various types. These parts are capable of being combined together in different ways, to form assemblies for the laboratory bench. They can be arranged to cover a wide range of speeds, up to over 5000 r.p.m. Lower speeds are obtained by means of the controlling rheostat and by using the small motor pulley to drive the large pulley mounted on the auxiliary bracket. As all component parts of the assemblies are listed separately, they can be added to the basic unit as required.

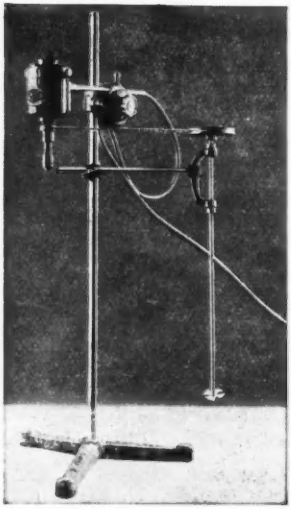

Fig. 1 (left) : Fig. 2 (above).

The design of the basic motor unit solves one of those problems often encountered when erecting this class of apparatus, *i.e.*, where to place the controlling rheostat. This difficulty has been overcome by mounting motor and rheostat alongside each other.

Both the stirrer and the turbidimeter are fully described and illustrated in booklets issued by the manufacturers.

Personal Notes

MR. R. E. FORDHAM has been elected a director of Lightalloys, Ltd.

MR. A. W. HILL has resigned his position of works manager and director of The British Drug Houses, Ltd.

MR. G. F. GREAVES has been appointed a director of Joseph Crosfield & Sons, Ltd., and of William Gossage & Sons, Ltd.

DR. G. W. MONIER-WILLIAMS, O.B.E., M.C., F.R.I.C., has been elected president of the Society of Public Analysts for the coming year.

SIR JOHN BOYD ORR, F.R.S., director of the Rowett Research Institute, is to receive the honorary degree of LL.D. of Edinburgh University, after the installation of the new Chancellor, Lord Linlithgow, on April 14.

DR. V. L. S. CHARLEY, who has been elected chairman of the Bristol & South-West section of the British Association of Chemists, is chief chemist to W. H. Carter & Co., Ltd., manufacturers of fruit syrups, and was formerly chief of the Fruit Products Section, University of Bristol Agricultural Research Station, Long Ashton.

DR. W. F. COXON, whose invention of the system of coloured target indicators in R.A.F. bombing raids has been reported in the *Daily Telegraph*, has been employed on research since 1940 in the Ministry of Aircraft Production. Previously, he taught chemistry at King Edward VI Grammar School, Five Ways, Birmingham, and before the war he was head of the chemistry department at the Regent Street Polytechnic.

The appointment of MR. C. S. ROBINSON, C.B.E., M.A., F.R.I.C., M.I.Chem.E., Director-General of Filling Factories, Ministry of Supply, to the post of head of the chemical industry branch of the British section of the Allied Control Commission in Germany, has now been publicly announced. Mr. Robinson was seconded to the M.O.S. from I.C.I. in 1939. According to the *Evening Standard*, his chief, Sir Andrew Duncan, has spoken in high praise of Mr. Robinson's leadership and his influence on morale in face of factory accidents and air-raid dangers. Educated at Nottingham High School and Cambridge, Mr. Robinson served in the last war as a private, and in 1916 was transferred to the Ministry of Munitions. Before joining Nobel Industries (later incorporated in I.C.I.) in 1925, he served as works manager at the Cape Explosives Works, South Africa, and as technical adviser to the Union Sulphur Co. of Louisiana at Marseilles. In 1938 he was appointed chairman of I.C.I. (General Chemicals), Ltd.

DR. HARRY MOORE who, as briefly recorded in this column last week, is appointed Professor of Glass Technology in the University of Sheffield from January 1, 1946, was educated at the Royal College of Science, London. After a period as demonstrator and lecturer in Physics, he transferred to the Munitions Training Department, King's College, London. Later he became technical supervisor for the Western Area and South Wales under the Ministry of Munitions, Training Section, and chief technical officer, S.W. England, for the Ministry of Labour, Training Department. Appointed assistant director of research of the British Scientific Instrument Research Association in 1919, he succeeded Sir Herbert Jackson, F.R.S., as director of research of that Association in 1933. He is at present director of research to Messrs. Pilkington Brothers, Ltd., St. Helens, a post he has held since 1937. Dr. Moore is also president of the Society of Glass Technology.

Obituary

MR. RALPH ROBERT WILKINS, who died very suddenly at Epsom, Surrey, on March 12, aged 64, was Director of Supplies (Special) in the Ministry of Supply, and was formerly a director of Victor Blagden & Co., Ltd.

MR. WILLIAM COWEN, who died at Lancaster on February 26, aged 41, was lecturer in chemical engineering in the faculty of technology of the University of Manchester from 1933 until October last, when he accepted an appointment with Messrs. Lansil, Ltd., Lancaster. He was largely responsible for the recent formation of a North-Western branch of the Institution of Chemical Engineers.

MR. ANTON JURGENS, who died at Torquay, Devon, on March 12, aged 77, was one of the pioneers of the margarine industry. The son of a butter-merchant at Oss, Holland, he began the development of margarine manufacture soon after entering business and during the last war his business attained world-wide dimensions. In 1929, with the late Sir Francis D'Arcy Cooper, he took a leading part in the formation of Unilever, Ltd. In 1933 he retired from business after the death of his only son.

PROFESSOR THOMAS J. NOLAN, D.Sc., F.R.I.C., whose death in Dublin is announced, was Dean of the Faculty of Science and Professor of Chemistry at University College, Dublin; he was chairman of the board of the Irish Industrial Alcohol Factories. For some years Professor Nolan was research chemist at the Nobel's explosive factory at Ardeer, later becoming Assistant State Chemist and then State Chemist in Eire; this last appointment he relinquished in 1930 to become Professor of Chemistry at U.C.D. Professor Nolan did much research work on the colouring matter of flowers. He had served as a Member of Council of the Royal Institute of Chemistry, his Fellowship in which dated from 1918.

General News——From Week to Week

Personnel of the Ministry of Fuel and Power have contributed £20,000 in pennies to the Red Cross Penny-a-Week Fund.

The resumption of business correspondence with Rumania has been authorised by the Board of Trade.

A colour-atlas and guide to the Diagnosis of Mineral Deficiencies in Plants by Visual Symptoms has just been published (H.M.S.O., 5s.).

The D.S.I.R. has issued summaries of literature on Water Pollution Research for December, 1943, and January, February, and March, 1944 (H.M.S.O., 2s. each).

DTD Specification, No. 635, Aluminium Alloy Sand or Die Castings (heat treated, not suitable for pistons), has just been issued (H.M.S.O., 1s.).

Department of Overseas Trade Reviews of Commercial Conditions have now been published for the U.S., Bolivia, Brazil, Chile and Peru (H.M.S.O., 6d. each, post free).

Eighteen new Fellows and 45 new Associates were elected by the Board of the Institute of Physics on March 12, while 17 Subscribers and 24 Students were also admitted.

Public service estimates just issued in Dublin show that expenditure on the Eire State Laboratory during the coming financial year will be £11,977, an increase of £1325.

Courtaulds plan to erect a large plant at Carrickfergus, near Belfast. The project is one of the largest industrial developments in Ulster for many years, and will give employment to several thousands of workers.

The chairman of Cerebos, Limited, Sir William Henry Collins, has given a cheque for £100,000 to the Royal College of Surgeons for the endowment of a Chair of Anatomy.

Technical education as the key to prosperity in the chemical industry was the subject of a lecture delivered last week to the Bristol and S.W. section of the British Association of Chemists by Dr. T. J. Drakeley, F.R.I.C., principal of the Northern Polytechnic, London.

Supplement No. 4 to the Ministry of Supply's *Raw Materials Guide*, dated December, 1944, has just been published (H.M.S.O., 1d.). It contains notes about Statutory Rules and Orders published between August and December, 1944, affecting fertilisers, iron and steel, miscellaneous chemicals, paper, and rubber; and, in addition, it gives particulars of the redistribution of certain Controls.

Only 30 additions are made to the "black list" of traders in neutral countries in the Trading with the Enemy (Specified Persons) (Amendment) (No. 4) Order, 1945 (S.R. & O., 1945, No. 283). There are about 300 deletions from the list, over 200 of these being in Chile.

Glasgow Corporation Committee on Post-War Planning is holding a conference on April 16 of various authorities with the object of reviewing the possibilities of industrial development in the area. It is contemplated that an Industrial Research Department might be set up by agreement as a result of the conference.

Under the new constitution adopted last week for the British Iron and Steel Federation, an economic efficiency committee is to advise on schemes of expansion or reconstruction and stimulate modernisation. There will also be a price policy committee. The new constitution is designed to promote maximum efficiency, give full play to enterprise, and at the same time "avoid the stifling of initiative by dictation or bureaucratic control"

It is authoritatively announced that the Eire Emergency Scientific Research Bureau is to be closed, probably this month. No provision will be made for its continuance in the estimates of the coming financial year, but proposals to replace the Bureau by an organisation or organisations which will carry on its work, or similar work, in normal times are under consideration. Legislation to this effect will be introduced before long into the Dail.

While the Board of Trade's wholesale price index for all articles (1930 = 100) remained unchanged at 167.2 last month, the index for chemicals and oils fell from 151.6 to 150.8 (against 151.4 last year), as a result of a decrease of 22½ per cent. in the price of lubricating oil. Compared with the last pre-war month, the index rose by 62 per cent. The indices both for iron and steel and for non-ferrous metals remained unchanged at 185.5 and 128.0 respectively.

The British Association of Chemists invites applications for the appointment of an additional officer for secretarial and organising work. Applicants should be chemists with organising and administrative ability. The starting salary will be £500 p.a. and the successful candidate will be expected to devote his full time to the affairs of the B.A.C. Applications in writing should be endorsed "Additional Officer" and received by the honorary secretary (Professor E. C. C. Baly, B.A.C., 175 Piccadilly, London, W.1) by March 31.

A second list of approved proprietary products for the control of plant pests and diseases has been issued by the Ministry of Agriculture. It is dated January, 1945, and supersedes the list of February, 1944. Products are arranged in ten distinct groups, and it must be understood that products in groups other than those shown in the list have not yet become eligible for consideration under the Ministry's voluntary scheme. An official mark on the label identifies an "approved" product.

A demand for the formation of a group of experienced organic chemists and plant physiologists to work in close collaboration with soil chemists and nutrition and disease workers on the study of pasture from the standpoint of chemical composition was made by Dr. James Stewart, of the Moredun Institute (Animal Diseases Research Association), at the Royal (Dick) Veterinary Hospital, Edinburgh. He hoped that in the near future a research institute or agricultural college would bring such a team together.

Addressing the Fuel Luncheon Club in London on Thursday last week, Mr. Robert Foot, chairman of the Mining Association, spoke about new ways of using coal. Referring to research and reconstruction during the next ten years, he pointed out that nobody could say our knowledge of coal, and how it could be used and developed, was as complete as it ought to be. Scientists, however, can do nothing without full backing by industry. . . . The best brains that can be procured are going to be put into research work in relation to coal immediately the war is over. . . . There is an unlimited field for first-class research work.

China clay was the subject of an address by Mr. Percy Harris, prospective Liberal candidate for the Penryn-Falmouth Division of Cornwall, at Falmouth Rotary Club last week. He mentioned that aluminium could be made from china clay, and had been during the war. It was not yet an economic proposition, but research workers were busy on the problem, and many new uses were assured for china clay after the war as a result of research. During the war there had been a drastic reduction in china clay output, but in 1939 the output was about 800,000 tons, while 1937 was the peak year for the industry, the output then reaching 890,000 tons. Many women had been employed in the industry during the war, but the arduous labour was not regarded as suitable for them.

Foreign News

A rich strike of copper and gold ore is reported to have been made by the Quemont Mining Corporation, a subsidiary of the Mining Corporation of Canada, at Rouyn, Quebec.

Local manufactures in Kenya include cleaning powder and metal polishes made from diatomite.

To develop the economic resources of the Gold Coast, an Economic Development Committee has recently been appointed.

A record total output of 5,586,492 lb. of vanadium, contained in ores and concentrates, was recorded in the U.S. in 1944.

Limited quantities of penicillin for the use of India's civilian population have been released by the American authorities.

An Iron and Steel Technical Training Institute is being set up in Dnepropetrovsk, while a similar institute already exists in Sverdlovsk in the Urals.

To expand Ceylon's pottery industry, technical advice is to be given at 30 centres. Local clay has been tested and found to be very satisfactory.

The Althing, the Parliament of Iceland, has agreed on a five-year plan to invest 300 million kr. in new industries, of which 50 million should be spent on fertiliser works.

Bofors A/B plans to erect a new large iron works at Karlskoga, near Bofors in Central Sweden, at an estimated cost of 26,000,000 kroner, employing 3000 to 4000 persons.

Belgian importers and distributors of tanning agents have formed an organisation at Brussels to represent their interests, the Association Belge des Tanins.

The Soviet Academy of Sciences has formed a branch in the Komi Republic, which lies partly beyond the Arctic circle. Its exploration activities have already resulted in the discovery of rich iron-ore deposits, and the erection of an iron and steel plant is being planned.

Celanese Corporation of America states, in the annual report for 1944, that a number of new subsidiaries have been formed, including the Celanese Chemical Corporation, which will handle sales of the group's chemical products, and Celanese Pan-American Corporation, to deal with the company's export business.

The first salt to be produced in Sweden has been extracted from wells in Scania. Output could be increased to meet about half the domestic needs which before the war averaged 230,000 tons a year. During the war the country has been depending on imports from Germany, though some supplies were recently obtained from Spain.

The new plant for the production of caustic soda and by-products at present under construction in Angra dos Reis, 75 miles to the west of Rio de Janeiro, will start production in the near future. It has been built by the Companhia Salgema Soda Caustica, and a large part of the machinery has been imported from the United States.

Commercial papers, up to a weight of 1 lb., may now be sent by post to those areas in France to which a letter service is in operation, at the rate of ½d. per 2 oz. (minimum 2½d.).

The American chemical and allied industry's production in 1944 was valued at $8,300,000, about two and a quarter times above the 1939 level, states the Chemical Bureau, W.P.B.

In the U.S.S.R., the number of factories producing plastics has almost doubled since the war, producing parts of motor cars, aeroplanes, lathes and many consumer goods, including sandals made from a new type of coloured plastic.

The East African Industrial Management Board is marketing a high-grade refractory brick made from kyanite found south-east of Kilimanjaro. This mineral will also be used in glass manufacture, for insulators in high-tension electric switchgear, and in many other cases where high temperatures are employed.

Underground gasification experiments are to be carried out at the abandoned pit of the Charbonnages de Bonne-Espérance, Batterie et Violette, at Wandre (near Liége, Belgium), with funds provided by the Fonds National de la Recherche Scientifique. A sum of 1,000,000 fr. has so far been provided. The process to be investigated has been developed by M. Pierre Romart, director-general of the company.

Germany's remaining oil-refining capacity continues to attract the attention of the Allied air forces. On Thursday last week a heavy attack was made on the Ruhland refineries, between Berlin and Dresden; other bombers from Italy raided the Moosbierbaum, Floridsdorf, and Schwechat oil refineries near Vienna. The attack on these targets was designed to knock out a quarter of Germany's oil production.

The Kara-Tau area, on the eastern shore of the Caspian in Kazakhstan (U.S.S.R.), is stated to contain phosphorite deposits with an estimated reserve of 1000 million tons of ore. Layers from 10 to 15 metres deep have, according to the Soviet Press, a yield of up to 30 per cent. phosphorus pentoxide, with small quantities of iron and aluminium. Several superphosphate plants are being erected in the area, in addition to a power station and a railway.

Forthcoming Events

March 24. Royal Institute of Chemistry Sheffield Metallurgical Society, 198 West Street, Sheffield, 2.30 p.m. Mr. U. R. Evans: "The Principles Governing Corrosion Resistance in Metals and Alloys."

March 24. The North of England Institute of Mining and Mechanical Engineers (Associates and Students' Section). Lecture Theatre of the Institute, Newcastle-on-Tyne, 2.30 p.m. General meeting. Mr. F. C. Dixon: "The Analysis of Coal, with Reference to its Utilisation"; Mr. Kenneth Henderson: "The Application of Scraper or Skip Conveyors."

March 26. Royal Institute of Chemistry. London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, 5 p.m. Dr. Harold Moore, C.B.E.: "Industrial Non-Ferrous Alloys."

March 26. Electrodepositors' Technical Society. Northampton Polytechnic Institute, St. John Street, E.C.1, 5.30 p.m. Symposium on Powder Metallurgy. Dr. G. E. Gardam: "The Preparation of Copper Powder by Electrodeposition."

March 27. Society of Chemical Industry (Agriculture Group), Burlington House, Piccadilly, W.1, 2.30 p.m. Symposium: 1, "The Supply of Protein for Animal Feeding"; 2, "The Extraction of Protein Foods from Plant Materials"; 3, "The Nutritive Value of Protein and Non-Protein Nitrogen for Ruminants." Contributors: Dr. A. B. Fowler, Dr. R. E. Slade, Dr. D. J. Branscombe, Mr. J. C. McGowan, and Dr. J. A. B. Smith.

March 28. The Institute of Fuel (Midlands Section). James Watt Memorial Institute, Birmingham, 2.30 p.m. Mr. F. Scarf: "The Fuel Research Coal Survey."

March 28. The Association of British Chemical Manufacturers. Lecture Hall, Royal Society of Tropical Medicine and Hygiene, Mansion House, 26 Portland Place, W.1, 2.30 p.m. Fuel Efficiency Technical Discussions (5th London meeting). Mr. G. Arrowsmith: "Thermal Compressors" (postponed from March 21).

April 13. Institution of Chemical Engineers. Annual meeting, Connaught Rooms, Great Queen Street, London, W.C.2. 11 a.m., Business session (Corporate members only). 12 noon, President's address: "A Byway in Chemical Engineering." 1 p.m., Luncheon (principal speaker, Sir Stafford Cripps). 3 p.m., Mr. H. W. Cremer and Mr. R. L. Fitt: "The Siting and Layout of Industrial Works." Those desiring luncheon are requested to notify the secretary not later than April 5.

Company News

The account for the **British Phosphate Commission** for the year ended June 30, 1943, shows that the surplus on trading account increased from £1,106 to £2,903.

The Electrolytic Zinc Co. of Australia, Ltd., is paying a 4 per cent. dividend on the preference and ordinary shares for the half-year ended December 31.

Lacrinoid Products, Limited, report a net profit for 1944 of £5522 (£5559). An unchanged final of 5 per cent., making 9 per cent. (same) was declared.

The British Aluminium Company, Ltd., has made a profit, for 1944, of £1,049,257 (£1,068,937). A final of 7 per cent. on ordinary, making 10 per cent., has been declared.

Bradford Dyers' Association, Limited, is able to show a rise in net profits of £51,299 for 1944, earnings being £441,348. A dividend of 5 per cent. (4 per cent.) was declared.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH ALUMINIUM CO., LTD., London, E.C. (M., 24/3/45.) February 24, disposition by Jno. A. Douglas with consent of the company, granted in implement of a Trust Deed dated September 12, 1934; charged on land with 108 South Alloa Road, Falkirk, and other buildings thereon with fittings and fixtures. *£3,270,644. April 14, 1944.

COLMORE ADHESIVES, LTD., Gateshead-on-Tyne. (M., 24/3/45.) February 10, charge, to Lloyds Bank, Ltd., securing all moneys due or to become due to the bank; charged on Sion House and lands at Birchanger and Stanstead. *——. March 10, 1943.

WILLIAMSON & BALL, LTD., Ashton-under-Lyne, dealers in oils, etc. (M., 24/3/45.) February 20, mortgage to District Bank, Ltd., securing all moneys due or to become due to the bank; charged on five plots of land with workshops, cottages and other buildings at and rear of Holden Street, Hurst Brook, Ashton-under-Lyne. *Nil. October 15, 1943.

RUBBER & TECHNICAL PRESS, LTD., London, S.W. (M., 24/3/45.) February 19, £25 debentures, part of a series already registered. *£325. September 1, 1944.

Satisfaction

ABRASIVE PRODUCTS, LTD., Bilston (Staffs). (M.S., 24/3/45.) Satisfactions February 27, £1000 and £1500 (not ex.), both registered July 9, 1940.

New Companies Registered

Ados, Ltd. (393,826).—Private company. Capital, £100 in £1 shares. Manufacturing chemists, etc. Directors: Olive M. Eatly; C. V. Burgess; A. H. Evans. Solicitors: R. S. Jackson & Bowles, 167 Fenchurch Street, E.C.3.

Beehive Plastic Materials, Ltd. (393,954). Private company. Capital, £1000 in £1 shares. Manufacturers of and dealers in plastic materials and goods, etc. Directors: H. Johnston; L. A. Humphrey. Registered office: 7 Chapel Walks, Manchester.

South Wales Vapour Testing Co., Ltd. (393,873).—Private company. Capital £1200 in £1 shares. Petroleum and other vapour testers, mechanical testers, technical inspectors, analysts, chemical consultants, oil merchants, etc. Directors: A. S. Minton; D. O. Davies. Registered office: 124 Bute Street, Cardiff.

James Strang & Sons, Ltd. (23,181).—Private company, registered in Edinburgh. Capital, £5000 in £1 shares. To acquire the business of soap, starch and glue manufacturers, carried on in Shuna Street, Glasgow, as (1) James Strang & Sons, and (2) Young & Strang. Directors: S. R. H. Strang; Joseph Millar; J. L. Douglas. Registered office: 50 Bilsland Drive, Glasgow.

Industrial and Scientific Instruments, Ltd. (393,932).—Private company. Capital, £1000 in £1 shares. Designers and manufacturers of instruments and equipment for the dairy, food, chemical and other industries, etc. Directors: W. A. Nell, director, Express Dairy Co., Ltd.; J. G. Davis, scientific adviser, Express Dairy Co., Ltd.; S. J. Ward. Registered offices: 15-17 Tavistock Place, London, W.C.1.

Panton Pulp, Ltd. (393,812).—Private company. Capital, £500 in 10,000 1s. shares. To produce and sell chemical pulps manufactured from straws and other fibrous vegetable materials, to construct manufacturing plants for installation in agricultural areas, moulders of plastic and other substances, etc. Directors: A. L. Panton; G. F. J. Harrington. Registered office: 65 Broad Street Avenue, E.C.2.

Carblox, Ltd. (393,790).—Private company. Capital, £100,000 in 100,000 £1 shares. To acquire those parts of the respective undertakings of Thos. Marshall & Co. (Loxley), Ltd., and the Morgan Crucible Co., Ltd., which manufacture and sell carbon blocks known as "Carblox"; manufacturers and dealers in carbon bricks, etc., used in the construction of furnaces. Directors: A. Marshall; T. Marshall; J. Walker; D. Dixon. Registered office: Loxley, near Sheffield.

Chemical and Allied Stocks and Shares

STOCK markets continued firm under the lead of British Funds, but the volume of business generally kept moderate, although confidence was again indicated by the small amount of selling in evidence. Leading industrial shares were well maintained, as a result of further indications of post-war plans and the switching over of factories for peace-time production. Courtaulds were firm at 55s. on the full results and the company's plans for expansion after the war. There was a firmer tendency in iron and steel shares, partly on the statement of the chairman of the Lancashire Steel Corporation regarding the position and outlook.

British Oxygen further strengthened to 88s. 10½d. on market hopes of a higher dividend, but British Aluminium became less firm at 45s. xd. and British Ropes 2s. 6d. shares eased to 7s. 7½d. Imperial Chemical firmed up to 39s. 4½d.: the preliminary results are expected about the middle of next month, and it is being confidently assumed that the 8 per cent. dividend basis, which has ruled for some years, is likely to be maintained. Dunlop Rubber showed firmness at 49s., but General Refractories at 16s. 6d., Borax Consolidated at 39s. 9d., and United Molasses at 37s. 10½d. were slightly less firm. The units of the Distillers Co. kept steady at 112s. 3d. In other directions, Gas Light & Coke ordinary hardened to 23s. 7½d., Barry & Staines were 53s. 9d., Nairn & Greenwich 77s. 6d., and Wall Paper Manufacturers deferred 43s. 9d., while Turner & Newall have shown firmness at 85s. 6d. Elsewhere, E. K. Cole moved higher at 40s. 3d., on the extension of the company's activities; it was stated that there have been developments, mostly secret, which the company thinks can be turned to account after the war. Amalgamated Metal firmed up to 17s. 10½d., Imperial Smelting were 13s. 9d., and British Plaster Board active and slightly higher at 39s., with Associated Cement steady at 62s.

Textiles have been firmer, aided by the Bradford Dyers' figures. Bradford Dyers' showed firmness at 26s. 6d. on the raising of the dividend by 1 per cent. to 5 per cent., and the balance-sheet position, which indicates that the group will be well placed financially to deal with expanding business after the war. Fine Spinners improved to 24s. 6d. on market dividend hopes, and Bleachers were firmer at 13s. 6d. Among iron and steels, Stewarts & Lloyds showed steadiness at 57s. 10½d. awaiting the dividend statement, expected early in April. Tube Investments were 111s. 3d., United Steel 26s. 10½d., and Powell Duffryn firmed up to 23s. 10½d., with Dorman Long 27s. 3d., Davy Engineering 33s. 10½d., Staveley 53s. 6d., and Allied Ironfounders 52s. 6d.

Blythe Colour 4s. shares were marked up from 11s. 3d. to 15s. 7½d. on the big dividend increase. Greeff-Chemicals 5s. shares changed hands up to 9s. 4½d. William Blythe 3s. ordinary were 9s. 6d., Fisons 50s., while B. Laporte have been dealt in up to 88s. 9d. W. J. Bush were 75s., and British Drug Houses 30s., with Burt Boulton 27s. 3d., and Cellon 5s. ordinary 24s. 6d. In other directions, Monsanto Chemicals 5½ per cent. preference were 23s., and Morgan Crucible 5 per cent. second preference 24s. 6d. International Combustion shares rose further to £7⅞. Babcock & Wilcox were higher at 53s., with Radiation steadier at 59s., and Cannon Iron Foundries 10s. ordinary around 18s. 9d.

Boots Drug showed firmness around 56s. Sangers strengthened at 31s. 9d., and Timothy Whites have been steady at 41s. 6d. British Glues were higher at 9s. 6d. Among plastics, De La Rue eased to £10 13/16 following their recent advance; British Industrial Plastics 2s. shares were 6s. 7½d., and Erinoid 5s. ordinary 12s. 3d. Oil shares became slightly easier, with Burmah Oil 85s. 7½d. and Shell 80s. 7½d.

British Chemical Prices

Market Reports

TRADE in general chemicals in the London market continues to pursue a steady course and firm price conditions characterise nearly all sections of the market. A fair amount of fresh inquiry is reported, while deliveries against contracts are proceeding along normal lines. In the soda products section, items such as caustic soda and bicarbonate of soda are receiving a good inquiry, while limited offers of yellow prussiate of soda and chlorate of soda are finding a ready outlet. Industrial refined nitrate of soda is in good request, and a steady inquiry is reported for both grades of the hyposulphites. The position of the potash compounds remain unaltered, and most items are in good call, the demand being in excess of available supplies. In other directions, hydrogen peroxide is in steady request, and a brisk trade is passing in white powdered arsenic, while glycerine remains firm. Interest is sustained in alum lump and acetone. Conditions in the market for coal-tar products continue as reported last week.

MANCHESTER.—Prices generally have been well held on the Manchester chemical market during the past week, and there is little indication of easiness developing in any of the heavy materials. Contracts in the alkalis are being drawn against satisfactorily, and there is a fair movement into consumption of carbonate and bicarbonate of ammo-

nia, carbonate of magnesia, and of heavy acids, while the potash compounds are being readily absorbed to the full extent of the quantities making their appearance. A satisfactory trade continues to develop in compound and other fertilisers. There is a continued good demand for the creosote and anthracene oils in the market for the tar products, and also for the benzols and toluols.

GLASGOW.—In the Scottish heavy chemical trade there has been no change during the past week, home business remaining moderate. Prices continue very firm, with no actual changes to report.

SITUATION VACANT

WANTED Analytical and Research Chemist by Manufacturers of Chemical preparations for the Boot and Shoe trade. Apply stating qualifications, experience and salary required. Box No. 2206, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

WANTED

WANTED regularly, Residues, Sludge, Slag, etc., containing Antimony, Cadmium, Copper, Lead, Nickel and Zinc. Oakland Metal Company Ltd., Willington, Derby.

WANTED.—Supplies of Nitre Cake in ten-ton lots, Box No. 2120, THE CHEMICAL AGE, 154, Fleet Street, E.C.4.

WORKING NOTICES

THE Proprietors of British Patent No. 477,743 for "IMPROVEMENTS IN HYDRAULIC GYPSUM CEMENT MATERIAL AND PROCESS OF MANUFACTURING THE SAME," desire to enter into negotiations with a Firm or Firms for the sale of the patent, or for the grant of licences thereunder. Further particulars may be obtained from MARKS & CLERK, 57 and 58, Lincoln's Inn Fields, London, W.C.2.

THE Proprietors of British Patent No. 499,529 for "PREPARATION OF ARSENICAL COMPOUNDS FOR USE IN SPRAYING OR DUSTING PLANTS," desire to enter into negotiations with a Firm or Firms for the sale of the patent, or for the grant of licences thereunder. Further particulars may be obtained from MARKS & CLERK, 57 and 58, Lincoln's Inn Fields, London, W.C.2.

THE Proprietors of British Patent No. 544,049 for "IMPROVEMENTS IN AND RELATING TO THE PRESERVATION OF WOOD AND LIKE ORGANIC SUBSTANCES BY IMPREGNATION," desire to enter into negotiations with a Firm or Firms for the sale of the patent, or for the grant of licences thereunder. Further particulars may be obtained from MARKS & CLERK, 57 and 58, Lincoln's Inn Fields, London, W.C.2.

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